



New confirmed record of *Diclidurus albus* Wied-Neuwied, 1820, Northern Ghost Bat (Mammalia, Chiroptera, Emballonuridae), in northern Costa Rica

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Abstract. We provided a new occurrence report with ecological notes of *Diclidurus albus* Wied-Neuwied, 1820, from Costa Rica. Two individuals were found roosting in the roof of a cabin of the Luna Nueva Hotel ecolodge in Peñas Blancas, San Ramón, Alajuela, Costa Rica. We provide a distribution map of previous visual sightings and the new record of this bat species from Costa Rica.

Keywords. Breeding season, distribution, mammal, mountain range, roosting

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Introduction

The genus *Diclidurus* Wied-Neuwied, 1819 includes four Neotropical species popularly known as ghost bats because of their whitish color: *Diclidurus albus* Wied-Neuwied, 1820, *D. ingens* Hernandez-Camacho, 1955, *D. isabella* Thomas, 1920, and *D. scutatus* Peters, 1869 (Ceballos and Medellín 1988; Hood and Gardner 2008; Reid 2009). *Diclidurus albus*, Northern Ghost Bat, is distributed from Mexico through Central America to northern Peru, Brazil, and Trinidad, from sea level to 1,700 m a.s.l. (Simmons 2005; Hood and Gardner 2008; Pedrosa et al. 2013; Loza et al. 2018; Pineda-Peraza et al. 2018). Currently, there are two valid recognized subspecies: *Diclidurus albus virgo* Thomas, 1903, occurring

from Mexico to northwestern South America, and *D. a. albus* Wied, 1820, occurring in the southern part of the species' geographic range (Ceballos and Medellín 1988; Hood and Gardner 2008).

Diclidurus albus is a poorly known species; not much is known about its biology, ecology, and distribution (Eisenberg and Redford 1999; Emmons and Feer 1999; Hood and Gardner 2008). It hunts mainly above the canopy and above the ground in open areas. Therefore, *D. albus* is rarely caught using mist nets (Ceballos and Medellín 1988; Reid 2009), and it is mainly recorded by echolocation (Jung et al. 2007). This species prefers humid habitats like riparian and tropical rainforests, but it also has been found in human-disturbed areas like plantations, clearings, and villages (Ceballos

and Medellín 1988). Individuals of this species are solitary, and like all members of the family, they are insectivorous (Ceballos and Medellín 1988).

In Costa Rica, *D. albus* is rare and distributed at low and middle elevations, from sea level to 1,500 m, on both the Pacific and Atlantic slopes and in the Central Valley (Goodwin 1946; Starrett and Casebeer 1968; LaVal and Rodríguez 2002). There are few occurrence records of this species in Costa Rica (Wilson 1983; Timm 1989; Rodríguez and Chinchilla 2002; Herrera-Rodríguez et al. 2014), and it has never been recorded in northwestern Costa Rica (Wainwright 2007). We report a new occurrence record, along with ecological notes, of *D. albus* in the Tilarán mountain range in northwestern Costa Rica.

Methods

The presence of the two individuals of *Diclidurus albus* was recorded using a Samsung Galaxy A71 smartphone. We deposited photographic records of the individuals in the Digital Catalog of the Museum of Zoology of the National University of Costa Rica (UNA-MZM). The individuals were identified following Ceballos and Medellín (1988), LaVal and Rodríguez (2002), Jung et al. (2007), and Hood and Gardner (2008). Individuals were not sexed because they were not captured. The observation includes habitat characteristics, activity time, and distance between the two individuals. In addition, we provide an updated database of distributional records based on museum specimens and other published and unpublished records from the Global Biodiversity Information Facility (GBIF 2022; Appendix Table A1).

Results

Diclidurus albus Wied-Neuwied, 1820

Figure 1

New record. COSTA RICA – **Alajuela** • San Ramón/Peñas Blancas; Luna Nueva Hotel; 10°23'11.0"N, 084°35'52.0"W; 327 m elev.; 31.VIII.2020; Morazán-Fernández obs.; 2 individuals, sex indet., not measured, roosting in the roof of a cabin, individuals separated by 10 m; photographic record UNA-MZM: 00002-3 (Fig. 2).

This locality is 27 km in a straight line (precision ~1 km) from the closest known locality of the species at San Luis, Monteverde, Puntarenas Province (Fig. 2).

Identification. Following Ceballos and Medellín (1988), LaVal and Rodríguez (2002), Jung et al. (2007), and Hood and Gardner (2008), *Diclidurus albus* can be initially identified in field by the following combination of characters: white fur, transparent wings, and the absence of noseleaf (Fig. 1). In Costa Rica, it is the only species of the genus *Diclidurus* (Herrera-Rodríguez et al. 2014) and is easily distinguished from the other whitish bat present in the country, *Ectophylla alba* H. Allen, 1892, White Tent Bat (family Phyllostomidae), which is a smaller species with a noseleaf. Furthermore, *D. albus* is the only bat species with a scent gland on its

tail (Wainwright 2007). *Diclidurus albus* is a medium-sized bat (forearm 60–70 mm; greatest length of skull <20 mm), with relatively long, soft, white pelage, the posterior border of the palate emarginate medially, and the mesopterygoid fossa not reaching the level of M3 (Hood and Gardner 2008).

Cabrera (1958) regarded *D. scutatus* as a synonym of *D. albus*, but currently these species are treated as separate species (Hood and Gardner 2008). Although these two species are sympatric in South America, and allopatric in Central America and externally similar, *D. albus* is easily distinguished from *D. scutatus* by its longer forearm (60–70 mm), the complete posterior margin of the palate, and the lack of a large fenestra in the palate (Hood and Gardner 2008). Although we did not capture and examine the individuals observed, it is not possible to confuse them with *D. scutatus* or *D. ingens* since these species are not distributed as far north; *D. scutatus* occurs in southeastern Colombia (Velasco et al. 2021) and the northeasternmost occurrence of *D. ingens* is in Puerto Ayacucho, Amazonas, in Venezuela (Handley 1976).

Discussion

Despite the large geographic range of *Diclidurus albus* in Costa Rica (Lim et al. 2016; Reid and Gómez 2022),

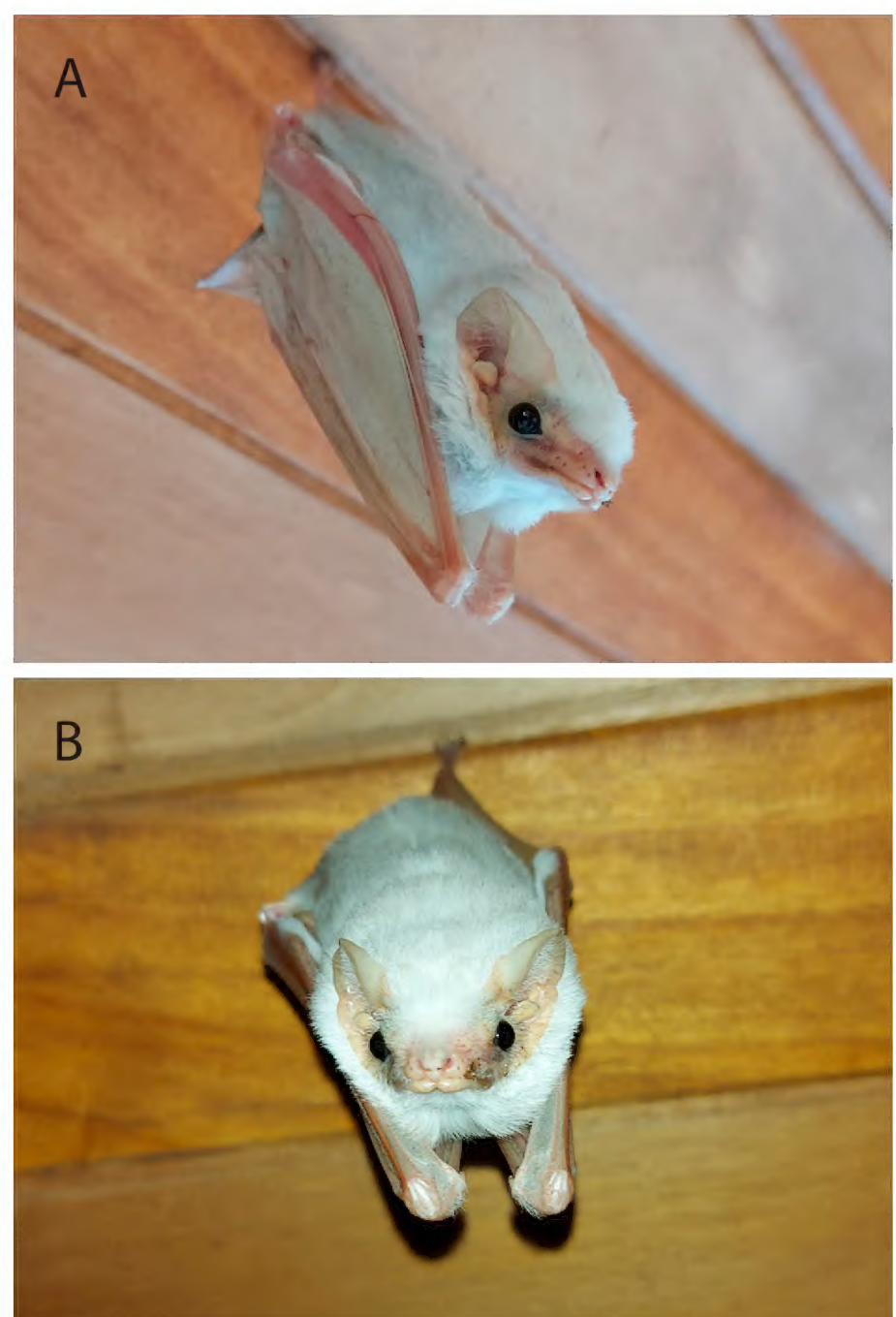


Figure 1. Individuals of *Diclidurus albus* roosting in Luna Nueva Lodge, Peñas Blancas, San Ramón, Alajuela, Costa Rica. **A.** Lateral view. **B.** Frontal view. Photographs by F. Morazán-Fernández.

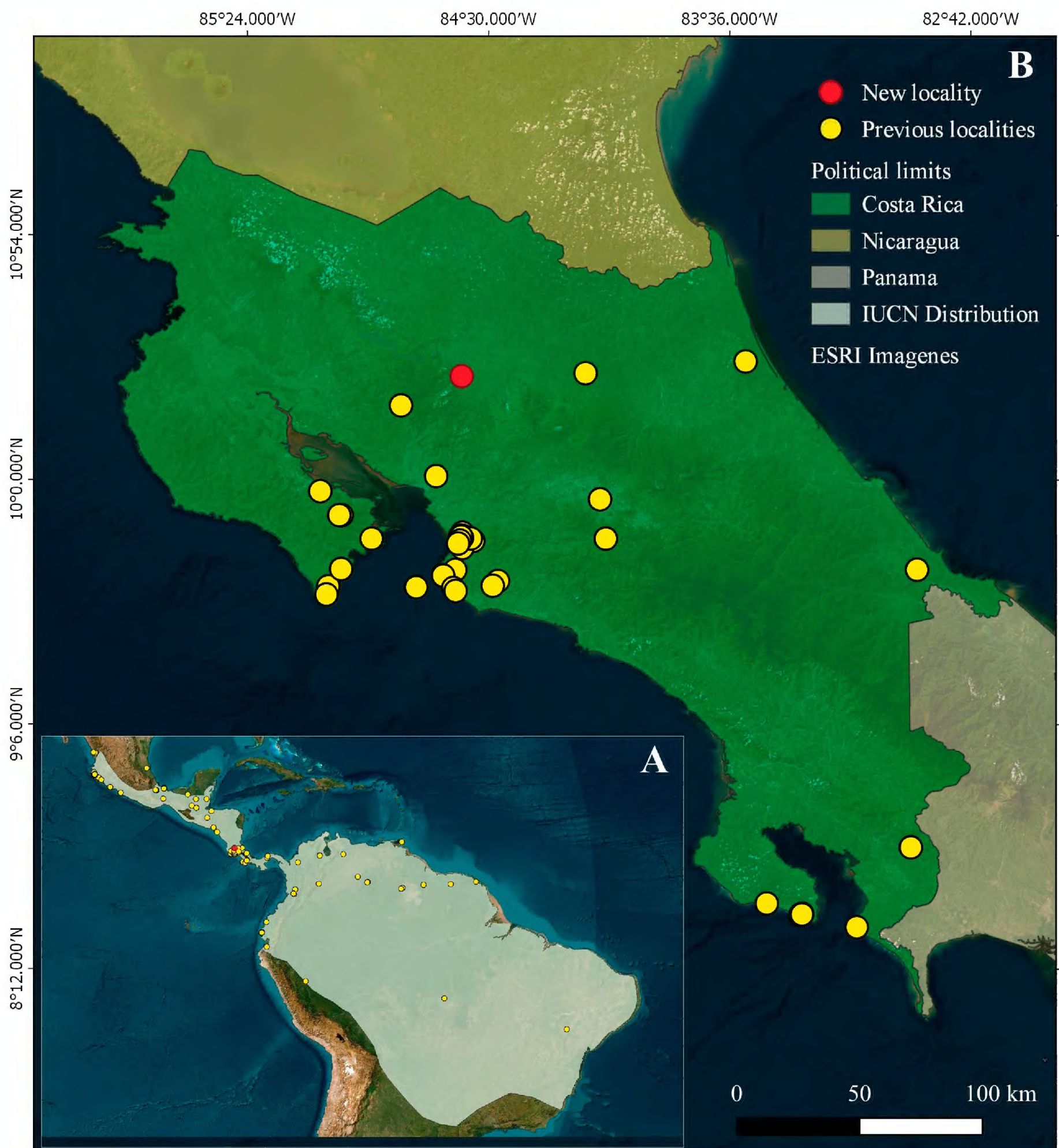


Figure 2. Distribution of *Diclidurus albus*. **A.** Distribution according to the IUCN (2016). **B.** Previous records (yellow dots) according to GBIF (2021) and our new record (red dot) from Costa Rica. Geographic coordinate system WGS84. Map by C.G. Herrera using QGIS v. 3.4.15 with Costa Rica 2014 shape files and ESRI imagery (©2022 ESRI).

Wainwright (2007) suggested that this species may also be present in some areas, such as the northern region. Even though *D. albus* probably occurs in these areas, there is no evidence to support its presence there. Occurrence records of this species are few and localized, and few specimens had been preserved in museums (Appendix Table A1). *Diclidurus albus* has mostly been recorded in lowlands on the Pacific and Caribbean slopes, with few records in the highlands and the central mountain range in Costa Rica (Fig. 2; GBIF 2021).

Additionally, observations on the natural history of *D. albus* are few. This bat species prefers roosting in vegetation with large leaves, like palms (Ceballos and Medellín 1988; Hood and Gardner 2008), but some

individuals also roost in human constructions (Moscoso and Tirira 2009; Gómez-Corea et al. 2020). Our new record complements the little knowledge available on the distribution of *D. albus* in northern Costa Rica, and it corroborates the presence of this species in human settlements.

According to Ceballos and Medellín (1988), *D. albus* does not form colonies and are found in small groups only during the breeding season in January to February. It has been seen roosting singly by day, except when aggregating into breeding groups, beneath the fronds of coconut palms. At the onset of the reproductive season, small groups consisting of a male and several females roost together (Hood and Gardner 2008). Although our

observation includes two individuals, their sexes could not be determined because we did not capture the bats. The reported breeding season of this species does not coincide with the time (late August) when we observed our individuals, which indicates that they may not be a breeding couple.

The distribution of *D. albus* in Costa Rica is restricted to very limited localities, where local habitat disturbance may have a negative effect on the ecology of species. Our new record contributes to the limited knowledge on this uncommon bat species, providing additional ecological and distributional information for this species in Costa Rica. However, acoustic monitoring and habitat modeling are still needed due to the inconspicuous habits and difficulty recording *D. albus* in the field.

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Author Contributions

Investigation: FMF. Validation: DRGS. Visualization: CGHM. Writing – original draft: JECS. Writing – review and editing: CGHM, JECS, FMF, DRGS.

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Appendix

Table A1. Occurrence data for *Diclidurus albus* in Costa Rica based on online databases (GBIF) and specimens from biological collections. Abbreviations: FMNH = Field Museum of Natural History, MCZ = Museum of Comparative Zoology, LACM = Natural History Museum of Los Angeles County.

Province	Locality	Geographic coordinates	Record type	Reference
Alajuela	La Fortuna	10.4418°N, 084.6674°W	Observation	iNaturalist 124830505
Cartago	San Juan Sur	09.7886°N, 084.0618°W	Observation	iNaturalist 19310200
Heredia	La Tirimbina Biological Station	10.3977°N, 084.1373°W	Observation	iNaturalist 323209
Limón	Bocuare	09.6722°N, 082.9074°W	Observation	iNaturalist 5273485
	Tortuguero National Park	10.4407°N, 083.5422°W	Observation	iNaturalist 4920604
Puntarenas	Ciudad Neily	08.6500°N, 082.9333°W	Specimen	LACM 25558
	Angostura	09.6148°N, 084.4814°W	Observation	iNaturalist 3807352, 107330477
	Barranca	10.0180°N, 084.6920°W	Specimen	FMNH 66226
	Cabo Blanco Biological Reserve	09.5812°N, 085.0981°W	Observation	iNaturalist 40152386
	Cabuya	09.6112°N, 085.0913°W	Observation	iNaturalist 150758003
	Carara National Park	09.7809°N, 084.6034°W	Observation	iNaturalist 105380115, 107334791, 150649281, 106888643, 109977265, 120623657, 68419314, 105370428, 37694147, 38557520, 109089137, 150272336, 69828779 10347061, 28747481, 4878172, 3819092, 74535458, 71990700, 9394430, 25441205, 41732639, 10139643, 9942017, 1767795, 54334841, 1101331, 1131203, 110197769, 5251637, 35846375, 380156, 113874314, 66718415, 113895496, 50782628 Observation.org 105253854, 126747301, 159829647, 169595130, 169719382, 83079477, 87991957, 98370063, 99975274
	Carate Wildlife Refuge	08.4445°N, 083.4667°W	Observation	iNaturalist 70189674
	Curú Wildlife Refuge	09.7873°N, 084.9311°W	Observation	iNaturalist 19090103
	Herradura	09.6727°N, 084.6205°W	Observation	iNaturalist 121340881, 64688261
	Jaco	09.6067°N, 084.6277°W	Observation	iNaturalist 1490974, 148933393
San José	Karen Mongensen Reserve	09.8736°N, 085.0512°W	Observation	iNaturalist 74964637, 1131203
	Monteverde	10.2781°N, 084.8231°W	Observation	iNaturalist 29904131
	Punta Banco	08.3567°N, 083.1343°W	Observation	iNaturalist 40329163
	Río Piro	08.4066°N, 083.3362°W	Observation	iNaturalist 111994137 ,145689289, 20537995, 20794144, 69462449, 20852010, 109190347
	San Jose	09.9333°N, 084.0833°W	Specimen	MCZ12317